Best Practices for Lean Scheduling and Coordination in Commercial Construction

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Efficiency and optimization are the money savers when it comes to the construction industry; what can be done to make this process go quicker and easier? Lean construction is the all-encompassing solution to this question, but while many understand the goal of lean construction, few can implement it in a way where it will be successful in saving time and money. Effective scheduling, coordination, and communication comes down to the quality of information flow within the project team. As a result, interaction effectiveness becomes one of the most crucial factors in determining the outcome of a project. By conducting a case study with a leading commercial general contractor in the California Bay Area, this project breaks down the Last Planner System, one of the main aspects of lean scheduling and coordination, in order to identify some of the best practices for quality information flow and implementation of lean construction in a company.

Key Words: Lean Construction, Last Planner, Information Flow, Best Practices, Touchplan.

Introduction

Time is money in the construction industry. Completing each step of the building process efficiently and correctly is the name of the game, and lean construction is the way to ensure that these objectives are met. Lean is defined as when something runs efficiently and with minimal waste (Oxford Languages). While it is a rather wide-reaching subject, the effective use of lean in construction comes down to great scheduling, coordination, and communication.

The success of each of these topics in construction; scheduling, coordination, and communication, depends on the quality of information flow within the project team. The main purpose of project team interactions is to share information and make decisions. In addition to these discernable outcomes, there are also unrealized outcomes that play a critical role in determining the effectiveness of subsequent interactions. These secondary outcomes relate to how the people involved valued the experience (how they felt), and how they valued the information (what they learned) (Phelps, 2019). The construction management process is built entirely around interactions. As a result, interaction effectiveness becomes one of the most crucial factors in determining the outcome of a project (Phelps, 2019).

Methodology

A case study project design was selected to gain insight as to how a project team can work to best implement lean scheduling and coordination. The case study focused on a leading midsize commercial general contractor in the California Bay Area, of which three employees of varying roles were asked to participate in semi-structured interviews. The interviewees included a senior project manager, a lean consultant, and a senior superintendent. Various questions relating to three main research ideas were asked to get an idea of how each team member uses lean, specifically when it comes to scheduling and coordination. Questions were adjusted to accommodate each interviewee and their personal role in the company, but the general research ideas are:

1) What lean construction techniques are already implemented in the company?
2) What is working well, and what are some areas for improvement?
3) What are the company's goals when it comes to lean scheduling and coordination?

Findings from the literature review and interviews were evaluated and compiled into a list of lean construction "best practices" for this, or any, general contractor to implement throughout their projects.

The objectives of this project are as follows:

1) To analyze the use of lean construction techniques by a general contractor to gather information regarding the best way for a company and project team to implement lean successfully and efficiently.
2) To create a list of best practices for general contractors to optimize lean scheduling and coordination across all projects.
3) To recommend the best ways to teach lean construction techniques such as the Last Planner Method and programs such as Touchplan to new project team members.

General Background

Last Planner

The Last Planner System is a planning, monitoring and control system that follows lean construction principles (Lean Construction Institute, 2015). The system can be used in many applications but is widely accepted as a standard in the construction industry as it "promotes conversations between trade foremen and project management at appropriate levels, and before issues become critical" (Lean Construction Institute, 2015).

While the system can be utilized at various levels of specificity, the main elements can be summarized in four steps, beginning with the very big picture of the entire project and increasing in detail until you reach weekly and daily planning and reporting.

The first two steps, master and phase scheduling, are strategic in nature; looking at what *should* occur throughout the course of the project. The last two steps, lookahead planning and daily coordination, are more accountability focused. These steps are more considering what *will* occur and what *is* occurring. Some may believe that just completing the milestone and phase planning is enough,

because at that point everything is technically planned, and they think their work is done. This is not true because for the full potential of the system to be reached, there needs to be follow-through, which comes from the inherent accountability of steps three and four.

Master Scheduling (Milestone Planning)

Milestone planning is simply looking at the entire project's master schedule and bringing those milestones to the attention of the project team.

Phase Scheduling (Pull Planning)

Pull planning is the bulk of the planning of how construction will flow. This determines who is doing what work at what time and in what place. The word "pull" refers to the technique of working backwards through a schedule: The team starts with the end in mind and plans the work based on completion of activities and available handoffs. The "phase" aspect comes into play in that pull plans are only completed in segments, usually split by project milestones or phases, and occasionally also split by project area.

The scope of the pull plan determines who should be involved. It is integral that those who are present are the individuals who will oversee carrying out each aspect of the work in question. This allows for proper answering of the three main questions (Lean Construction Institute, 2015) of a pull plan:

1) Do we understand how we are going to do the work?
2) Have we collaborated with the right people to make the work happen?
3) Are we confident we can deliver the milestone?

With all the key players in the room (or virtual room), the team can run through the section of the project in question and decide as a team who will be working in what area at what time, virtually rehearsing the execution of the project. Having all relevant team members present helps to increase trust by assuring that everyone understands the plan and helps to uncover future issues in the planning phase rather than during construction.

Lookahead Planning (Weekly Work Planning)

Lookahead planning is the nuts and bolts of how and when exactly the work will be completed now that a general plan is in place. This consists of a 2-6 week lookahead, usually occurring once per week; identifying (1) what tasks need to be completed, (2) what work these tasks will entail, (3) where the task will take place, (4) when the task will take place, and (5) who will complete the task (Lean Construction Institute, 2015). This last item, assigning a task to an individual(s) is very important as it increases accountability. This lookahead planning time is also when the team will determine what new trades will be coming to the site, and any important deliveries that they should be expecting.

Daily Coordination (Daily Huddles)

Daily huddles are the connection between what *will* occur, what *is* occurring, and what *has* occurred. Most teams will have separate daily huddles for the internal GC team and for the foremen on site, with the GC foreman and superintendent likely attending both meetings. In these meetings, there are three main questions asked:

1) What happened yesterday? Does it match with what was planned?
2) What is going on today?
3) Do you need anything to get today's work done?

The daily huddle is where reporting begins. This is how a team tracks the success and accuracy of their team in their planning and execution of the work. Percent Plan Complete (PPC) is the metric that gauges the reliability of the planning system; the number of planned activities completed is divided by the total number of planned activities, then expressed as a percentage (Lean Construction Institute, 2015). When an activity is not completed when it was planned, a constraint is listed with the activity to explain why it is now out of schedule. Constraints can be anything from lack of labor to delivery delay or miscommunication.

Visual Tools and Technology

Visual tools and technology can be some of the simplest direct contributors to successful lean construction. Visual auxiliary tools around the job site such as a delivery board and laminated floor plans allow for team members to reference that information easily without needing to return to the job trailer to check their computer or disrupt another team member by asking them an easily answered question.

The Last Planner System has its own visual tool set; the most basic form of which is a whiteboard, pens, and various colored post-it notes. The board will be split vertically into columns for each day of the week, usually showing about 2-4 weeks on the board at a time. Horizontally, the board will be split into what are called "swim lanes" if the project is complex enough to need to be split into geographical areas, or if a separate plan is needed for day versus night work. Each trade has their own colored post-it, and one activity is written per post-it. During the pull planning process, each trade can write their activities onto the post-it, including a number in the corner to show the duration (in days) of the activity, then place it on the board in relation to the other activities.

Figure 1 – The Visual Last Planner System
Source: Lean Construction Blog

As is the case in nearly every industry, many construction planning processes are moving online. There are many online versions of this classic post-it board, but a rising favorite among the industry is called Touchplan. This program captures all the basics of the post-it board, but adds the capability for collaborative editing, and automatically tracks metrics such as constraints and PPC.

On the right of the screen, team members can create virtual color-coded post-its with the title of the activity, assigned trade partner, location, duration, and manpower required for the task. This is the equivalent of milestone planning.

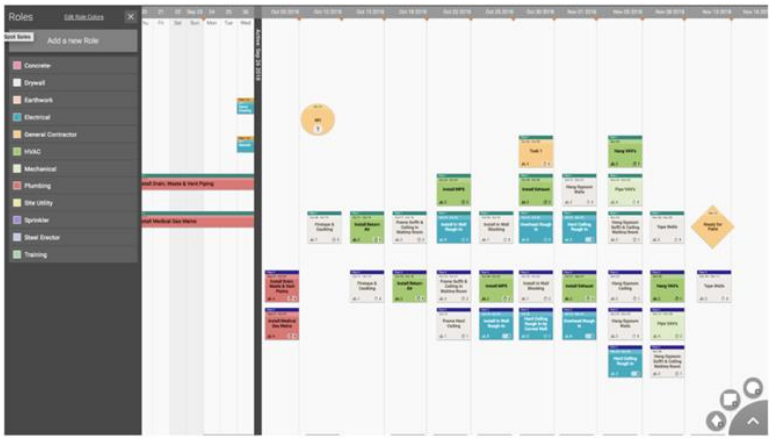

Figure 2 – Milestone Planning in Touchplan
Source: Touchplan

When the "active" bar is slid to the right, it adjusts these activities from squares to rectangles, showing the relative durations of each activity, more like a classic Gantt chart. This is where Touchplan turns into a great tool for phase planning and weekly work planning.

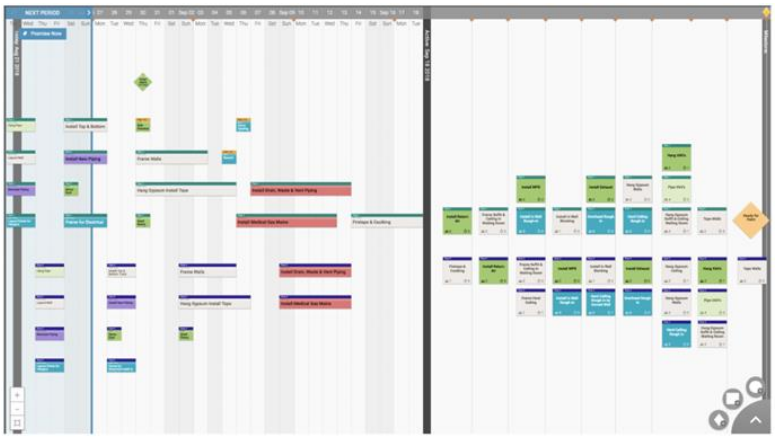

Figure 3 – Phase Planning in Touchplan
Source: Touchplan

As daily huddles occur, the activities coming up can be "promised" and then as they are completed, constraints can be assigned if the activity was not finished exactly on schedule.

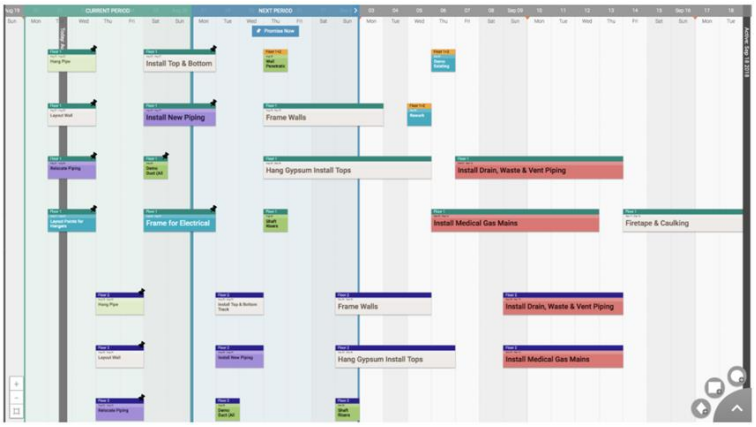

Figure 4 – Weekly Work Planning in Touchplan
Source: Touchplan

Touchplan has the capability to create reports for numerous metrics, such as PPC:

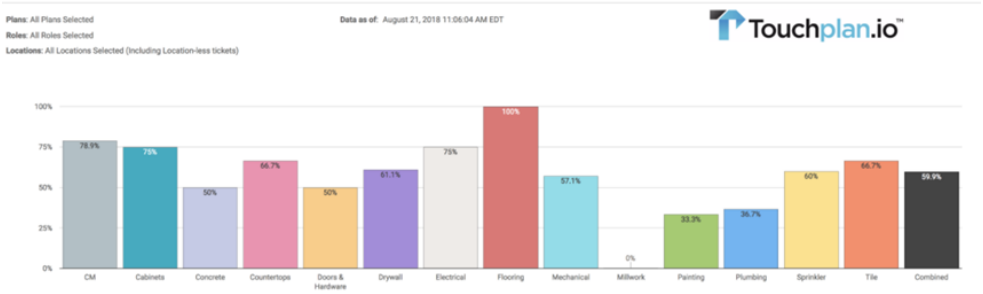

Figure 5 – PPC Report in Touchplan
Source: Touchplan

Best Practices

This is a "toolkit" of best practices. It is meant to be utilized to the team's best ability, and customized and adjusted for each new team or project. No team or project is the same, so no plan will work for every instance. Flexibility is key but having the basics down will allow for easy adjustments.

General Lean Principles

- Always work to simplify required information as much as possible and streamline processes to optimize everyone's time.
- Define lean expectations in the bidding process of the project, that way everyone is on the same page about any added costs or efforts that may be incurred throughout the construction process to fulfill these expectations.
- Implement Lean Process Management Checks (Phelps, 2019) when possible:

    - Feedback check: The use of tools built into the information flow process to identify problems when they arise. The sooner problems are identified, the less impact they will have on the outcome. This can be accomplished by implementing mini deliverables for activities to help identify problems when they arise rather than at the end.
    - Pull check: Answers the question of if everything being done is really needed. By starting with the desired outcome and working backwards, one can evaluate whether each step is required. This eliminates waste by having all activities solely adding value.
    - Workload leveling check: Can team members realistically complete their responsibilities in time and to the required level of quality?

General Scheduling

- It saves cost to spend extra time in a planning meeting to sort out any possible problems rather than rushing the meeting and having a problem occur during construction.
- Activity descriptions are integral as they must be understandable by anyone on site.
- In the shift to more technological scheduling programs and meetings, avoid the loss of interpersonal "side" conversations. Find ways to facilitate small group conversation even in online meetings as these conversations can be highly important in pull plans but can be missed when conducting planning in an online setting.
- Ensure that those who are most familiar with the work being planned are involved in the scheduling process as the most realistic insight comes from those who will be doing or overseeing the physical work.
    - This will help get buy-in from those individuals as they are now a part of the process, allowing them to take ownership for the work and inherently be held more accountable.
- Utilize location-based scheduling when possible. Breaking work into smaller, repeatable chunks (especially when working in multiple areas) will optimize flow and increase relations between trades.

Pull Planning

- The leader makes or breaks a pull plan. A well-prepared leader can still create a successful pull plan even if everyone else is relatively unprepared, but if everyone is prepared but the leader is not, very little will be accomplished.
    - The second most important person in a pull plan is the one who organizes it. Getting in contact with and sharing relevant information with all involved parties is very important so everyone comes prepared and knows what to expect.
- Understanding the scope of the pull plan is important to ensure that only those who are necessary are invited, and that the correct amount of time is allotted to maximize everyone's time. Missing key players will cause a lack of information, while being short on time will create a feeling of being rushed. Too many people can create either a disorganized frenzy, or individuals will lose interest and check out. Allotting too much time will make everyone restless and will allow for the discussion to get to a point where it goes in circles with little being accomplished.
- When it comes to trade partners, it is important to have the one who is running the work (superintendent or foreman) present, as well as the one responsible for paying for the work, or at least someone with the power to decide about overtime or rushed deliveries, etc.

- It is important to have drawings and digital information (Google Maps, virtual whiteboard, etc.) readily available during a pull plan, and to anticipate when it may be needed to assist in talking through a coordination issue or to visually explain an idea.

Visual Tools

- When it comes to visual auxiliary tools, the five feet in five seconds rule is a simple and helpful way to ensure that information is properly displayed. This rule simply states that the main idea of any visual tool should be easily understood from five feet away in five seconds by anyone who may be coming to the site.
- A highly visual representation of commitments works to increase accountability as having more eyes on the action items list makes more individuals aware of what is to be done and by who.

Teaching Lean Techniques

- When planning to use a program or technique in a meeting, lay out the expectations in the invite and find out who is not familiar with the processes then get them up to speed so they can participate. This can be accomplished by having them come 15 minutes early for a brief run-through, or by including links to basic instructions in the meeting invite.
- People revert to what they know. When teaching a new technique, be there with the individual you are teaching as they are learning the new tool so that you are there when they need help. If help is not present, it is likely that they will revert to their old techniques.

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